



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
WASHINGTON, D.C. 20460

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MEMORANDUM

Sept 1, 1989

OFFICE OF  
PESTICIDES AND TOXIC SUBSTANCES

SUBJECT: Permethrin, Oncogenic Risk Assessment for Military Use on Fabric

TO: Karl Baetcke, Ph.D.  
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Health Effects Division (H7509C)

FROM: Robert P. Zendzian Ph.D. 9/1/89  
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Health Effects Division (H7509C)

Per your request I have performed an oncogenic risk assessment for the use of permethrin as an insect repellent on military uniforms. The worst case lifetime risk ranges from  $1.3$  to  $3.2 \times 10^{-5}$ . As noted below, this worst case over estimates the risk by orders of magnitude. Correcting for the most obvious over estimates gives a lifetime risk of  $1.4$  to  $3.5 \times 10^{-7}$ .

Background

The U.S Army has proposed the use of permethrin as an insect repellent on combat uniforms. This use will involve the periodic treatment of uniforms with permethrin and result in dermal exposure to the individuals wearing the treated uniforms.

Permethrin has been classified, by the HED Oncogenic Peer Review Committee, as a Class C oncogen with a  $Q^*$  of  $1.84 \times 10^{-2}$  (mg/kg/day)<sup>-1</sup>.

Calculations

"Nondietary Exposure Branch (NDEB) estimates that the dermal exposure from wearing permethrin treated BDUs (combat uniforms) will average 0.0056 mg/kg/day and total 2.0 mg/kg/ year for a 70 kg individual. The estimates are not adjusted for dermal absorption of permethrin (assumes 100% absorption) and are based on the unlikely scenario of an individual wearing the BDU for 24 hours/day and for 365 days/year." (Lunchick, 1989)

A dermal absorption study of permethrin from treated fabric in the rabbit showed that between 30.9 and 73.1 % of the permethrin that was deposited on the skin was absorbed (Doherty 1988).

We assume that the individual spends 30 years of a 70 year life span in the U.S. Army wearing treated uniforms.

$Q^* \times \text{annualized exposure} \times \frac{\text{years exposed}}{\text{life span}} = \text{life time risk}$

$$Q^* = 1.84 \times 10^{-2}$$

Annualized exposure (systemic)

$$\text{Dermal exposure} = 0.0056 (5.6 \times 10^{-3}) \text{ mg/kg/day}$$

Systemic exposure;

1. For an absorption of 30.9% =  $1.7 \times 10^{-3} \text{ mg/kg/day}$

2. For an absorption of 73.1% =  $4.1 \times 10^{-3} \text{ mg/kg/day}$

$$\text{Lifetime exposure} = \frac{30}{70} = .43$$

Risk for the low absorption rate

$$1.84 \times 10^{-2} \times 1.7 \times 10^{-3} \times .43 = \underline{1.3 \times 10^{-5}}$$

Risk for the high absorption rate

$$1.84 \times 10^{-2} \times 4.1 \times 10^{-3} \times .43 = \underline{3.2 \times 10^{-5}}$$

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The following obvious over estimates are included in these calculations;

1. Exposure

24 hours/day, more likely 16 hr/day, correction factor 0.66

12 months/yr, more likely 3 months/year, correction factor 0.25

30 years, more likely 20 years, correction factor 0.66

Combined correction factor 0.11.

2. Dermal absorption. The rabbit skin has been established as being 10 to 15 times more permeable than human skin.

Correction factor 0.10.

Risk corrected for overestimates

$$\text{Low absorption} = \underline{1.4 \times 10^{-7}}$$

$$\text{High absorption} = \underline{3.5 \times 10^{-7}}$$

References

Memo, Lunchick to La Rocca, Registration of Permethrin for Military Uses 7/31/89

DER, Doherty, Special study - Dermal Absorption from fabric - Rabbits 11/30/88

cc

Budd

Doherty

Lunchick